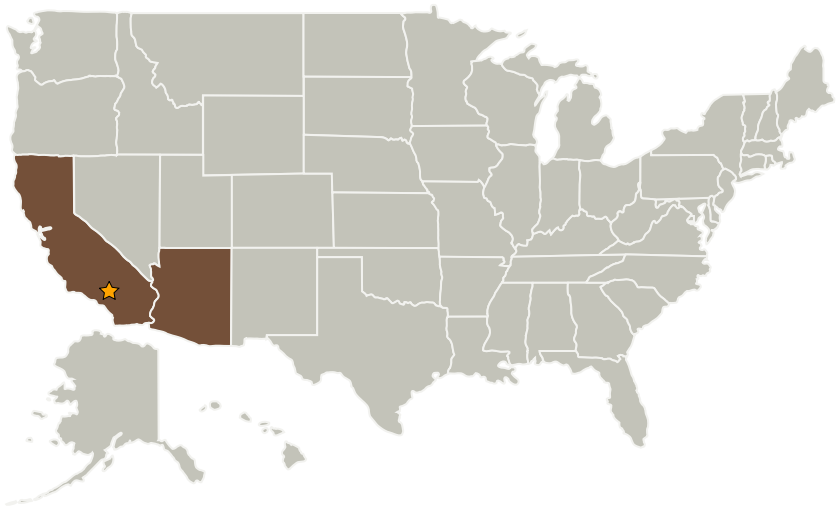
Nonlinear Aerodynamics-Structure Time Simulation for HALE Aircraft Design/Analysis, Phase I

Completed Technology Project (2005 - 2006)

Project Introduction

Time simulation of a nonlinear aerodynamics model (NA) developed at Virginia Tech coupled with a nonlinear structure model (NS) is proposed as a design/analysis methodology for highly flexible HALE/morphing aircraft. With this nonlinear aero-structure (NAS) approach, large structure deformations and static/dynamic aeroelastic responses of such flexible aircraft can be properly accounted for including all dominant linear/nonlinear effects. The vortex dynamics coupling and spline procedure in NAS render it an ideal tool for expedient time simulations. The proof-of-concept example demonstrates the validity of the NA model and its aeroelastic applicability to a HALE flying wing in an open and closed loop control environment. Pathfinder/Helios flying wing will be selected as the candidate NAS feasibility study case. Further, ZONA Technology will integrate this methodology into an user-friendly, open-architecture software with a highly modular format using the ZONA Database Management (ZDM) system. Phase I effort will focus on the NAS for wing-only configurations. Phase II will enlarge our scope to include modules in time-domain gust, NAS-aeroservoelasticity, and interfacing with commercialized nonlinear structural FEM, and to increase the geometric complexity for wing-body and realistic aircraft configurations. The ZONA team intends to work closely with NASA and AeroVironment throughout these phases.

Primary U.S. Work Locations and Key Partners



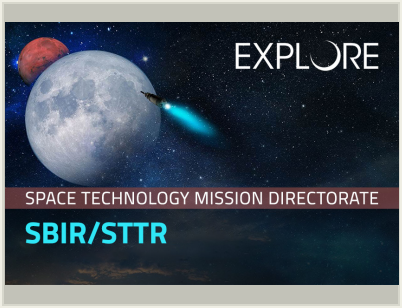


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Table of Contents

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Armstrong Flight Research Center (AFRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Armstrong Flight Research Center(AFRC)	Lead Organization	NASA Center	Edwards, California
ZONA Technology, Inc.	Supporting Organization	Industry Small Disadvantaged Business (SDB)	Scottsdale, Arizona

Primary U.S. Work Locations	
Arizona	California

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX15 Flight Vehicle Systems
  - TX15.1 Aerosciences
    - TX15.1.3 Aeroelasticity